
2002 MM5 Sensitivity Runs

**Missouri Department of Natural Resource
Air Pollution Control Program
Regional Modeling Group**

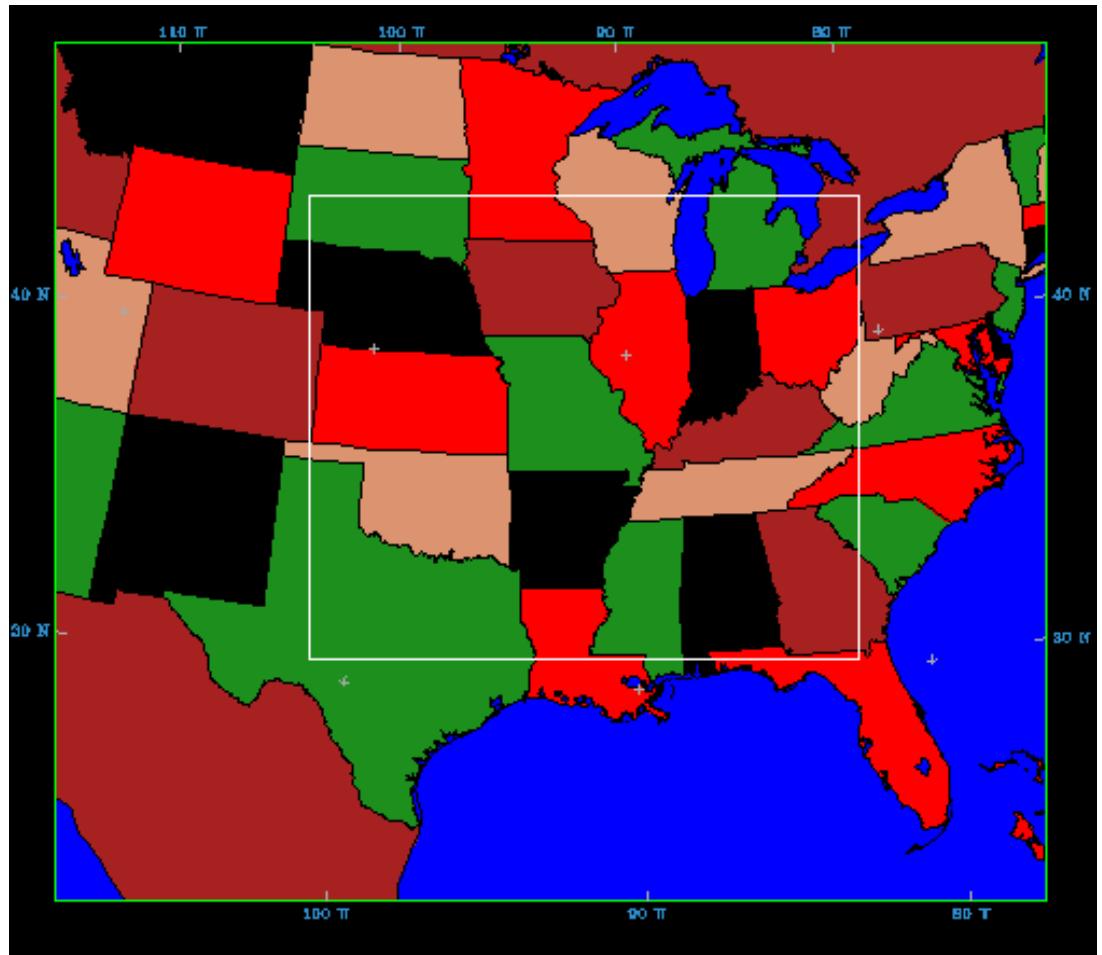
**St. Louis 8 hr Ozone/PM2.5 Technical Meeting
EastWest Gateway, St. Louis MO
June 16, 2004**

Overview

- **Basic Information**
 - > Model Configuration
 - Domain
 - Input Data
 - Physic Options
 - > Computational Requirements
- **Evaluation**
 - > January & July 2002
 - > Metstat (Surface Statistics)
- **Summary and Conclusions**

MM5 Domain

- Domain 1 (36km)
 - MM5 165x129x34
 - CMAQ 147x111x18
- Domain 2 (12km)
 - MM5 180x100x34
 - CMAQ 162x82x18
- Evaluation Criteria
 - Synoptic Evaluation
 - Statistical Evaluation using METSTAT and surface data
 - WS, WD, T, RH



Configurations

- **Run 1 (Blackadar)**

- > CP = Kain-Fritsch II
- > Moisture = Reisner II
- > Radiation = RRTM
- > PBL = Blackadar
- > Surface = 5-layer soil model

- **Run 2 (Eta)**

- > CP = Kain-Fritsch II
- > Moisture = Reisner II
- > Radiation = RRTM
- > PBL = Eta PBL
- > Surface = OSU-LSM

- **Run 3 (MRF)**

- > CP = Kain-Fritsch II
- > Moisture = Reisner II
- > Radiation = RRTM
- > PBL = MRF PBL
- > Surface = 5-layer soil model

- **Run 4 (Pleim-Xiu)**

- > CP = Kain-Fritsch II
- > Moisture = Reisner II
- > Radiation = RRTM
- > PBL = Pleim-Xiu
- > Surface = Pleim-Xiu LSM

January MM5 Performance Plots

- **Daily Performance Plots**
 - > Bar graphs of performance metrics:
 - Daily output from January 1-7 and January 8-14
- **Hourly Performance Plots**
 - > Line graphs of performance metrics:
 - Daily output from January 1-7 and January 8-14
 - Observed/Predicted
 - » Wind Speed
 - » Temperature
 - » Humidity
 - Bias/Gross Error
 - » Wind Speed
 - » Temperature
 - » Humidity

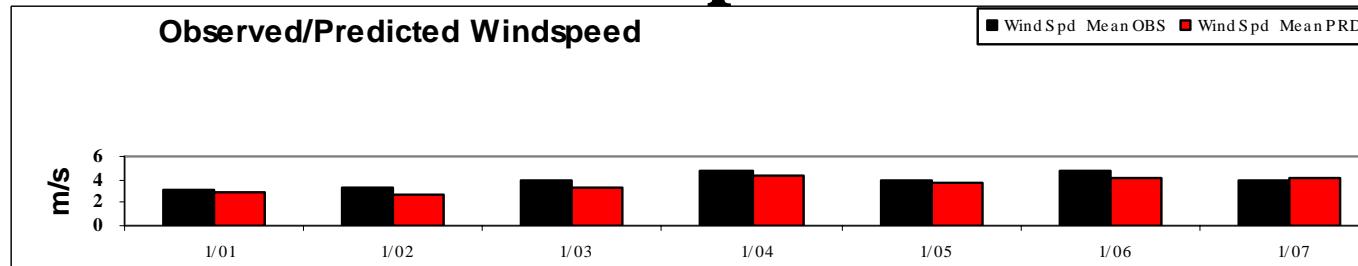


January MM5 Performance Plots

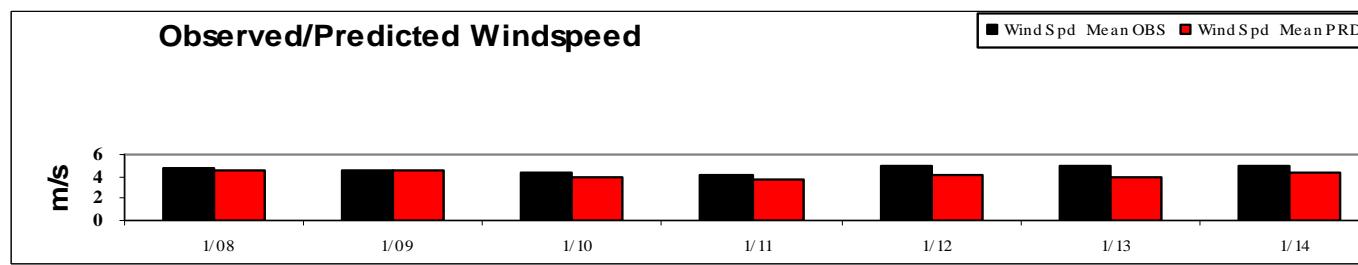
Daily Analysis

Comparison of Daily Observed/Predicted Wind Speed

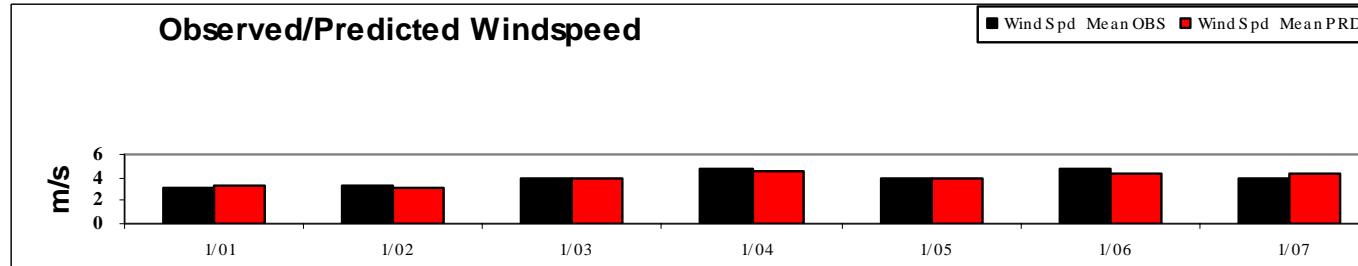
Eta
Day 1-7



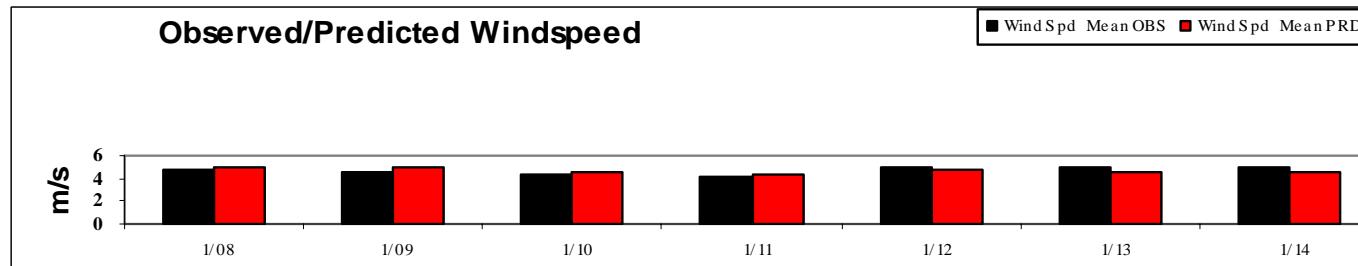
Eta
Day 8-14



Pleim-Xiu
Day 1-7

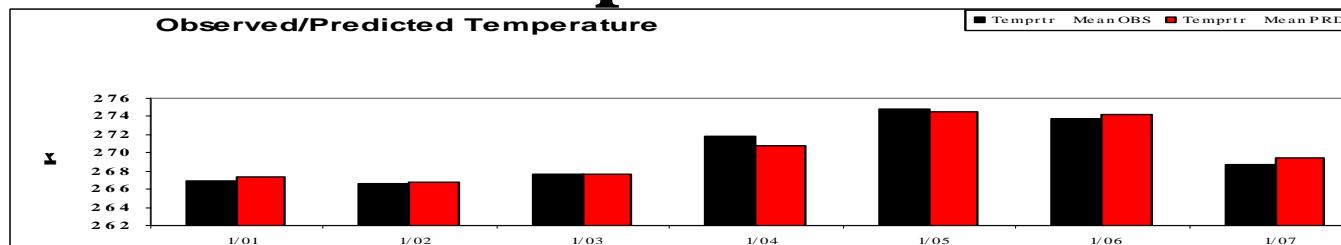


Pleim-Xiu
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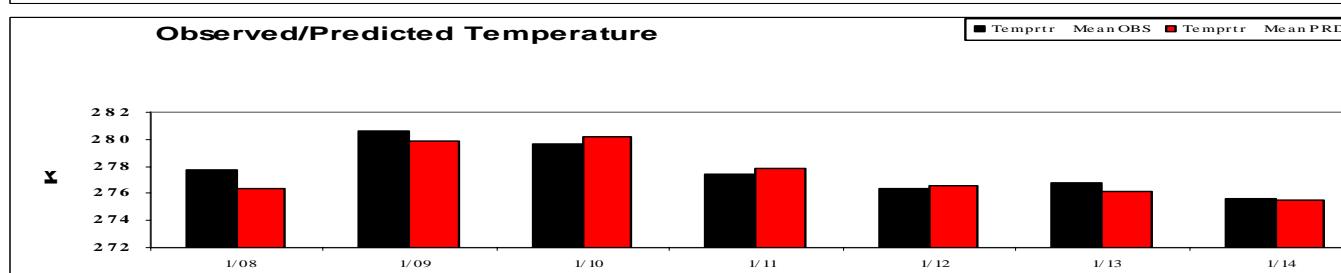


Comparison of Daily Observed/Predicted Temperature

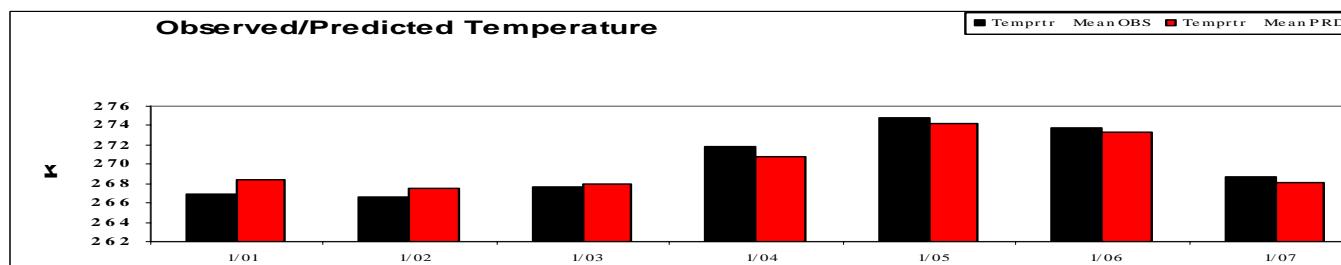
MRF
Day 1-7



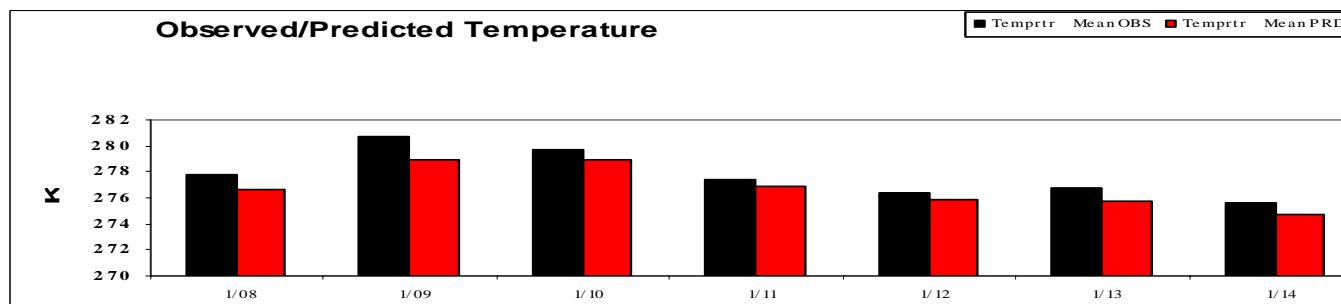
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Day 8-14



Pleim-Xiu
Day 1-7

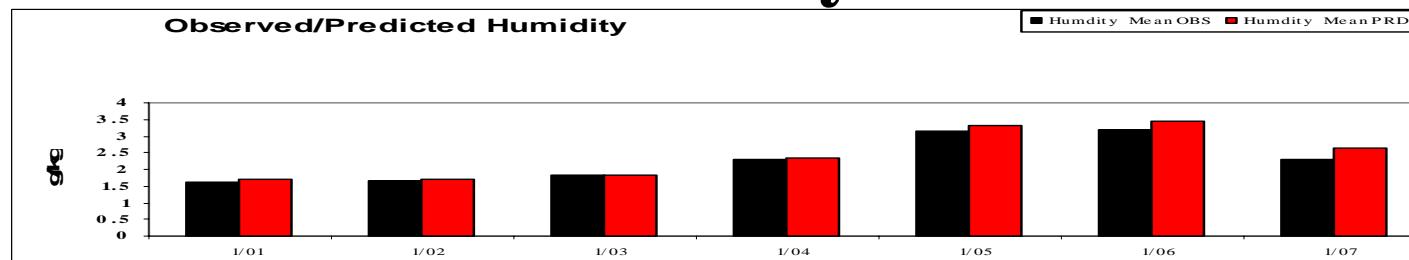


Pleim-Xiu
Day 8-14

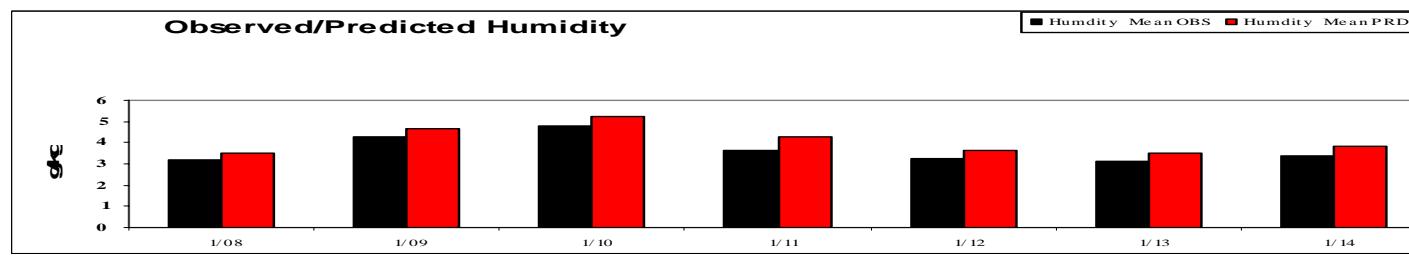


Comparison Daily Observed/Predicted Humidity

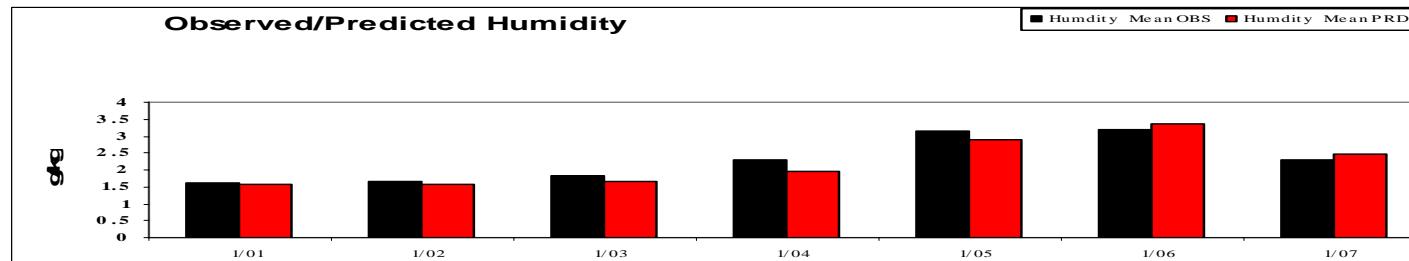
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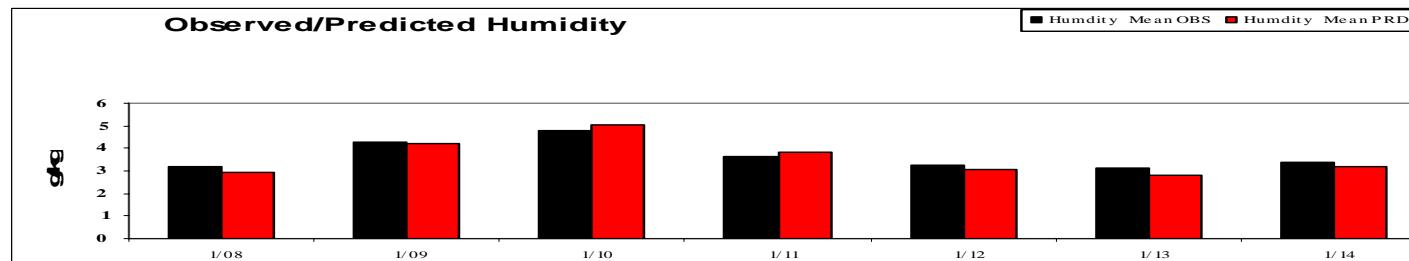
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Day 8-14



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Day 1-7



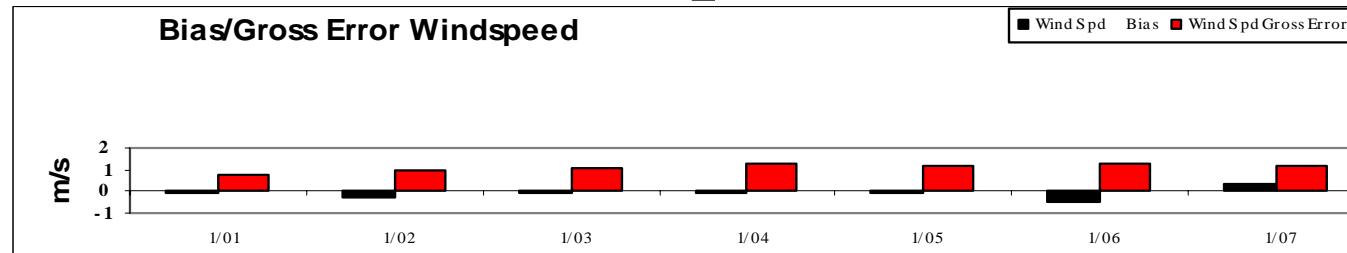
Pleim-Xiu
Day 8-14



Comparison of Daily Bias/Gross Error Windspeed

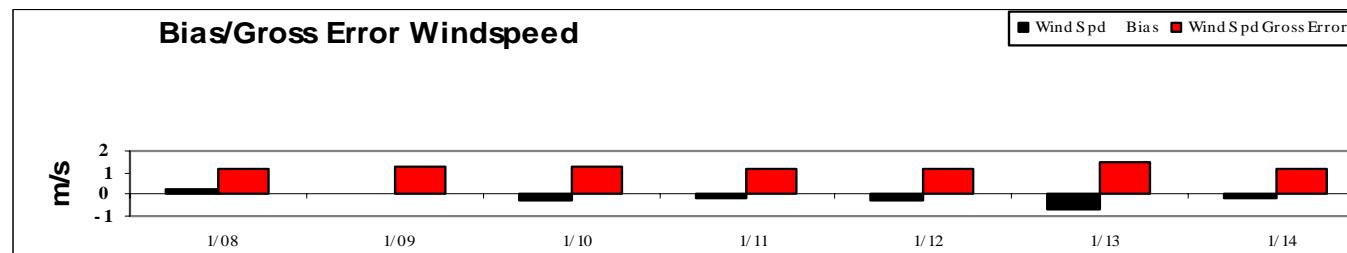
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Day 1-7



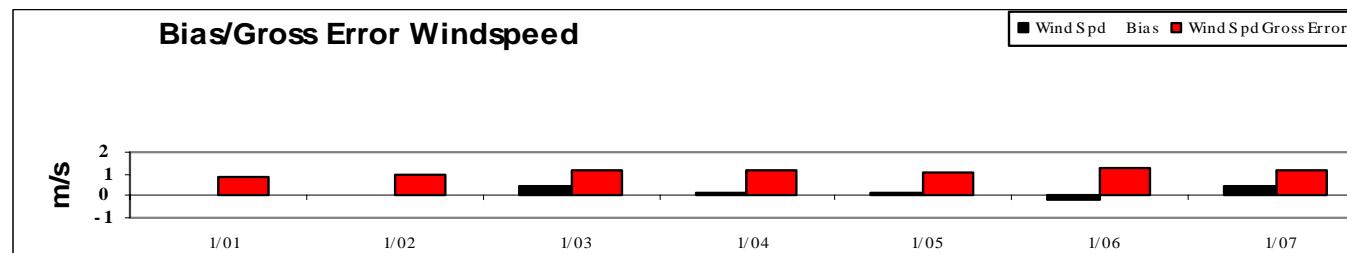
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Day 8-14



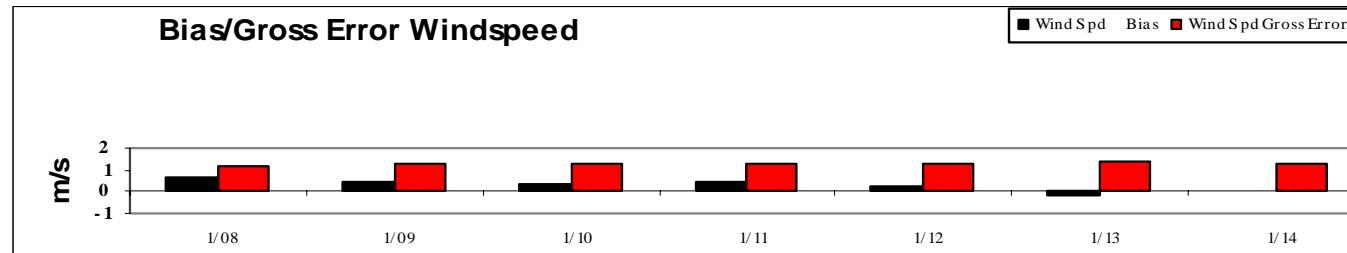
Pleim-Xiu

Day 1-7



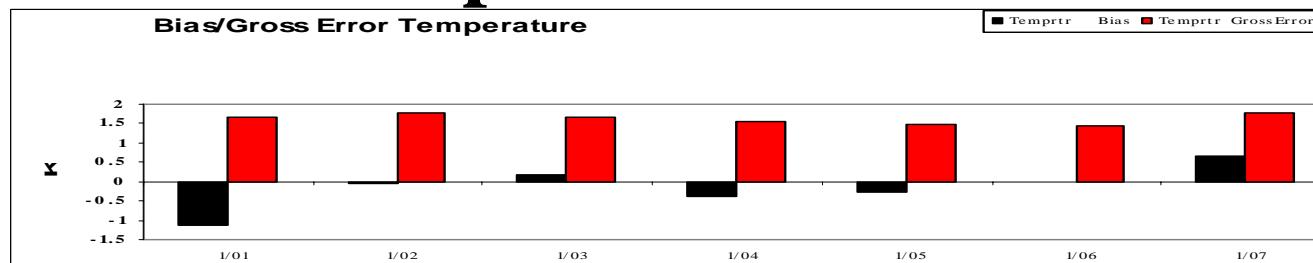
Pleim-Xiu

Day 8-14

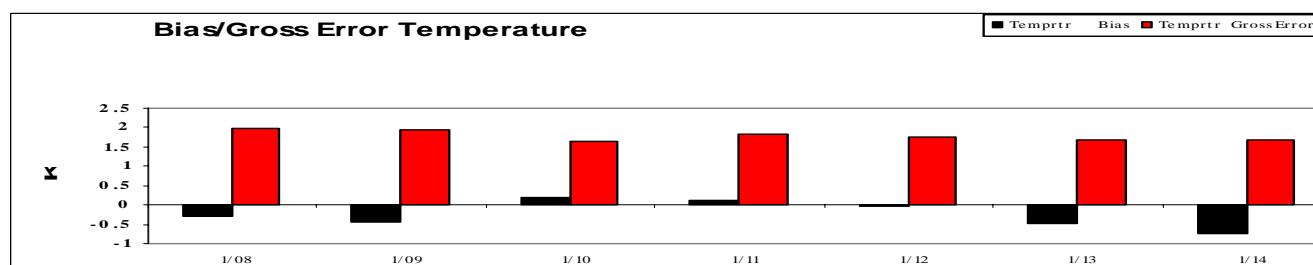


Comparison of Daily Bias/Gross Temperature Error

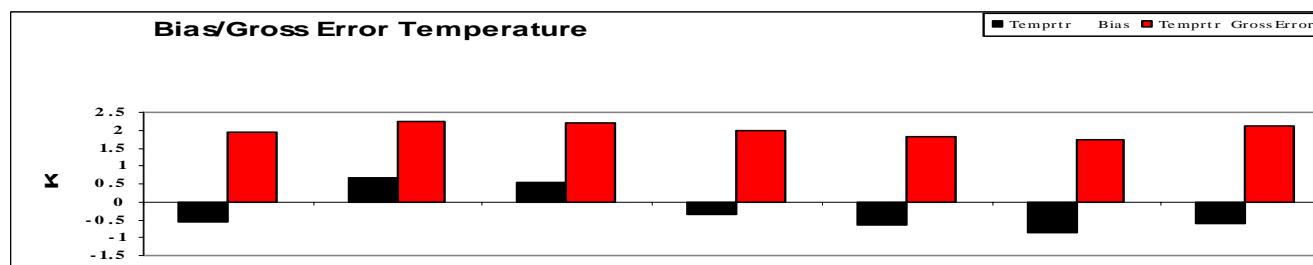
MRF
Day 1-7



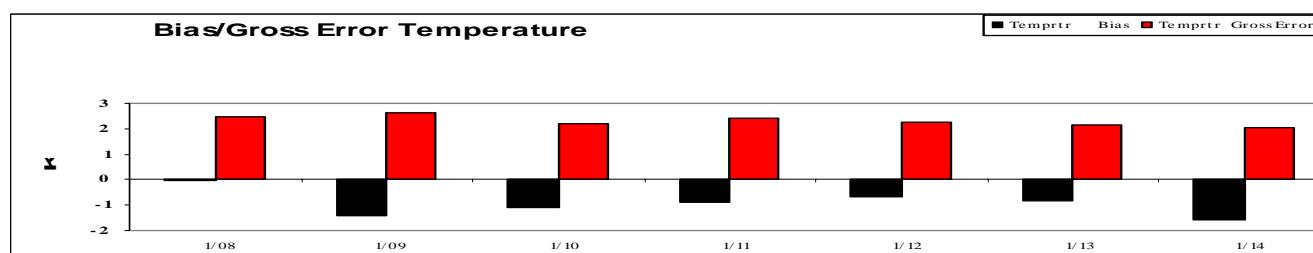
MRF
Day 8-14



Pleim-Xiu
Day 1-7

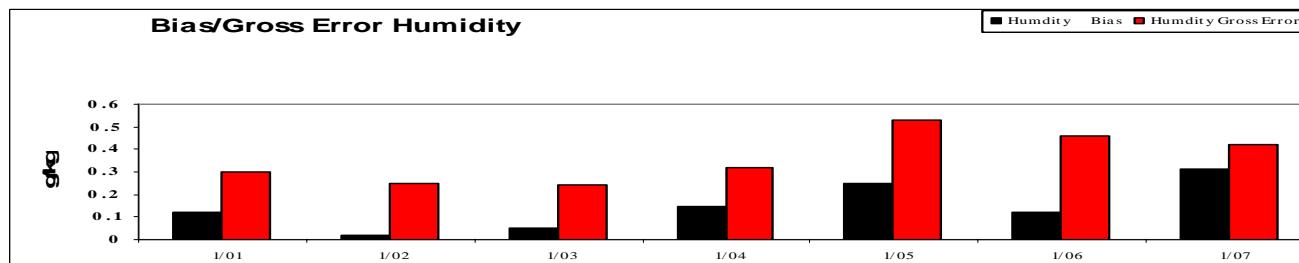


Pleim-Xiu
Day 8-14

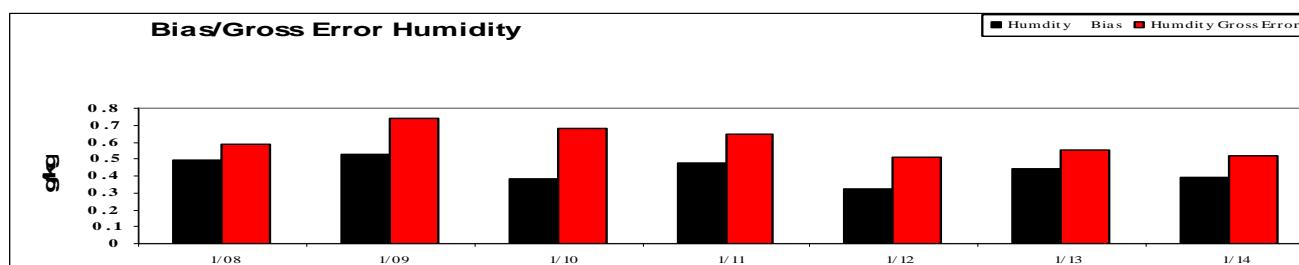


Comparison of Daily Bias/Gross Humidity Error

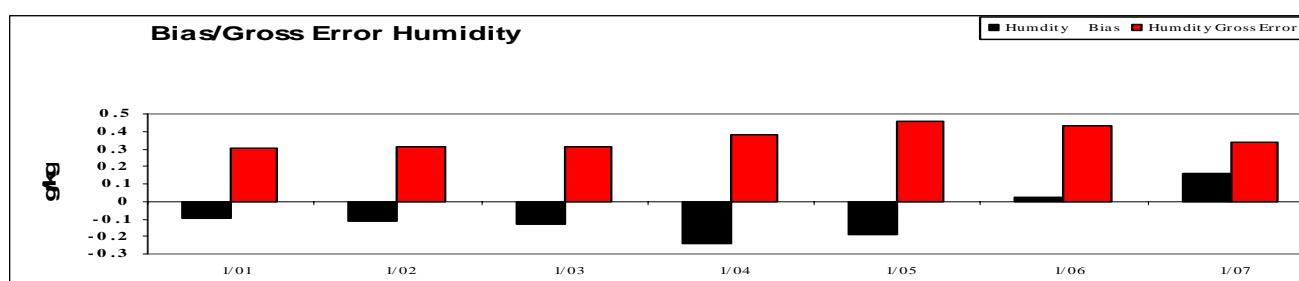
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Day 1-7



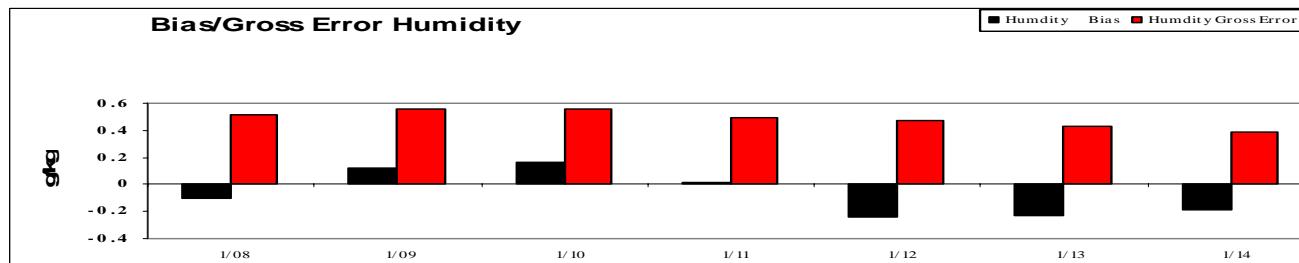
Eta
Day 8-14



Pleim-Xiu
Day 1-7



Pleim-Xiu
Day 8-14

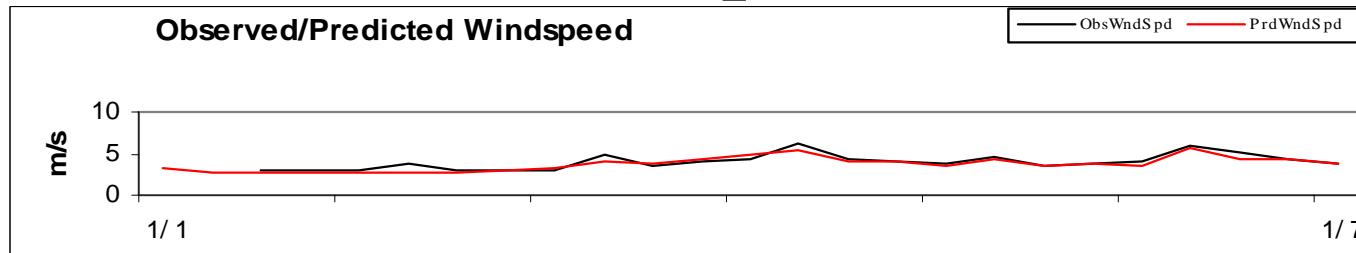


January MM5 Hourly Performance Plots

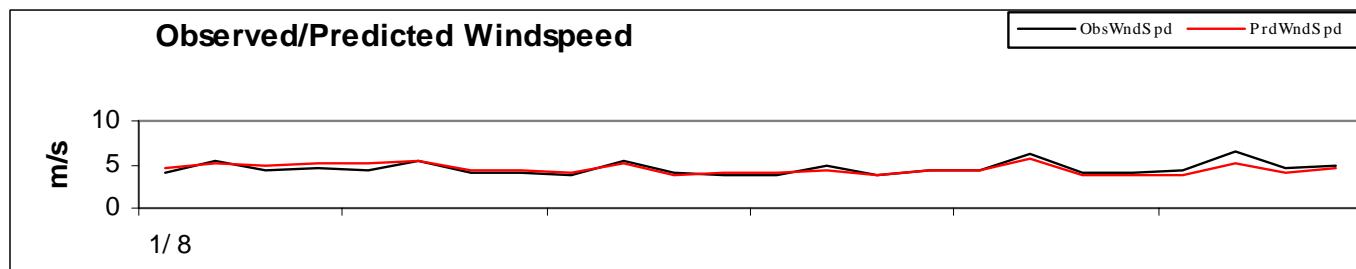
Hourly Analysis

Comparison of Hourly Observed/Predicted Wind Speed

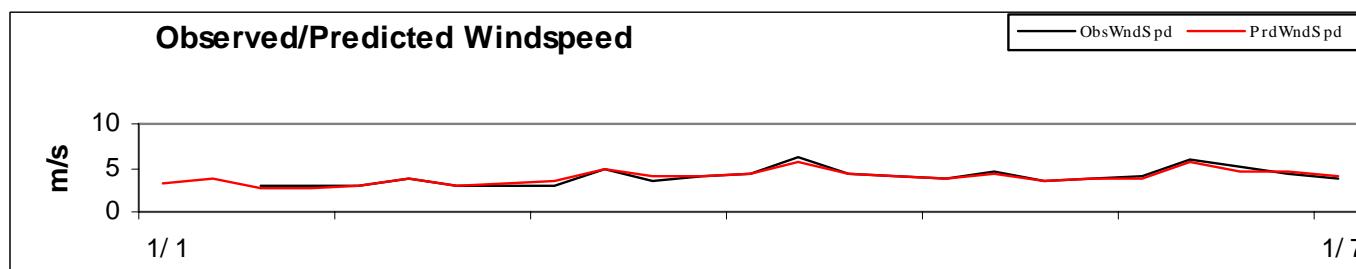
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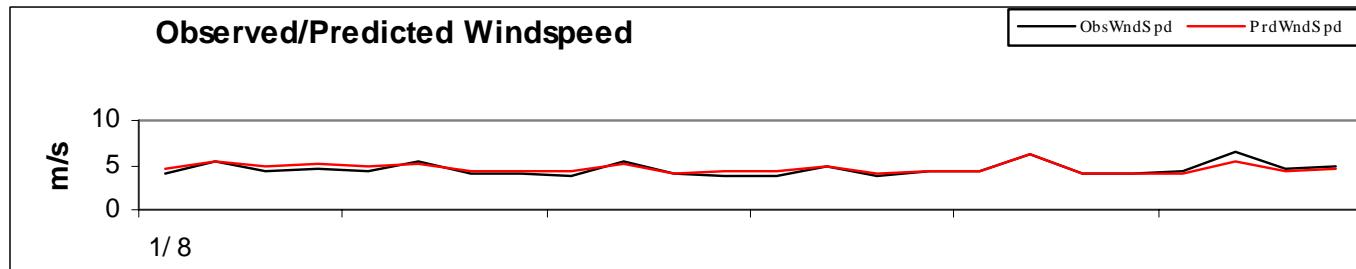
MRF
Day 8-14



Pleim-Xiu
Day 1-7

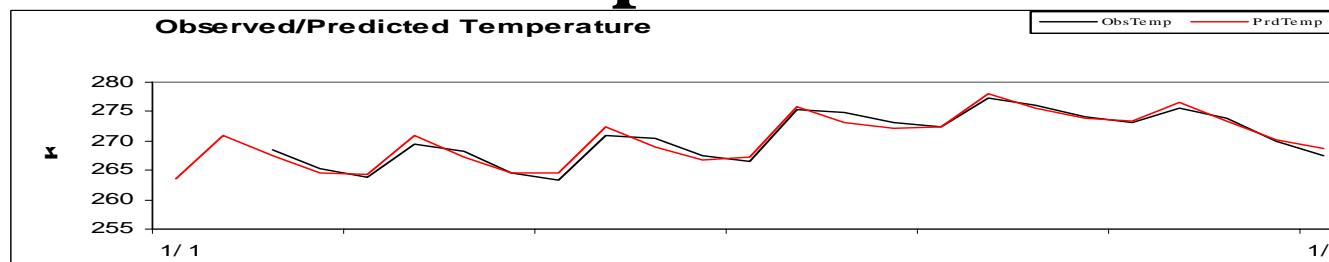


Pleim-Xiu
Day 1-7

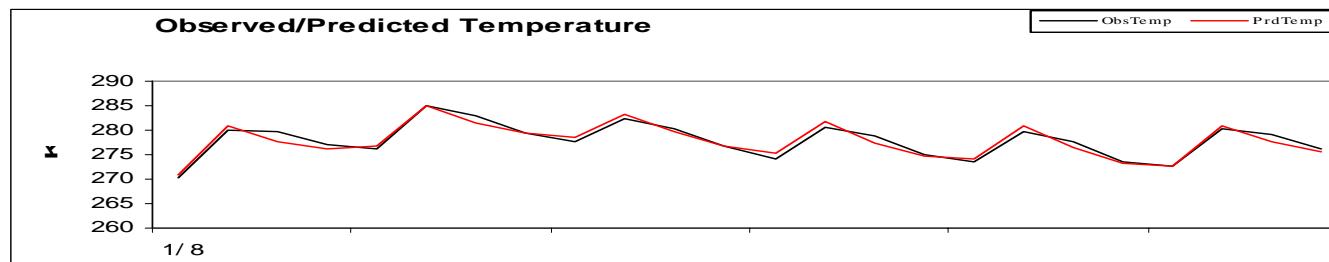


Comparison of Hourly Observed/Predicted Temperature

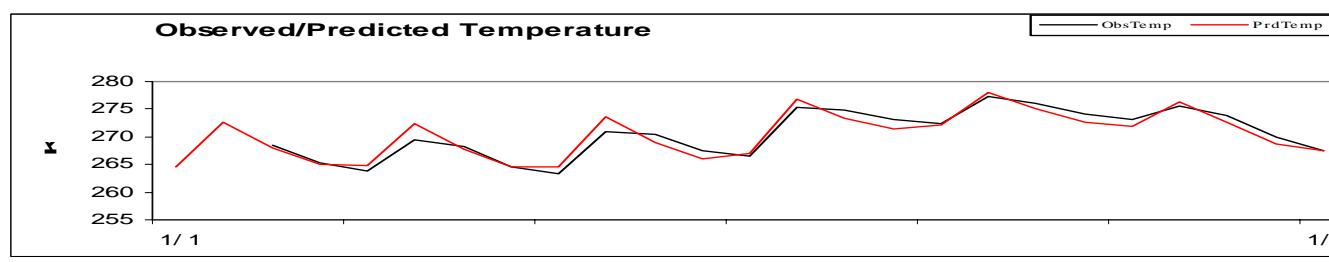
MRF
Day 1-7



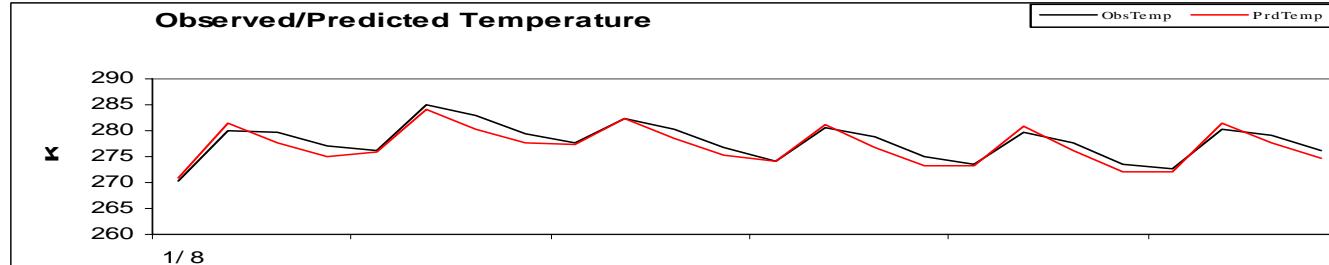
MRF
Day 8-14



Pleim-Xiu
Day 1-7

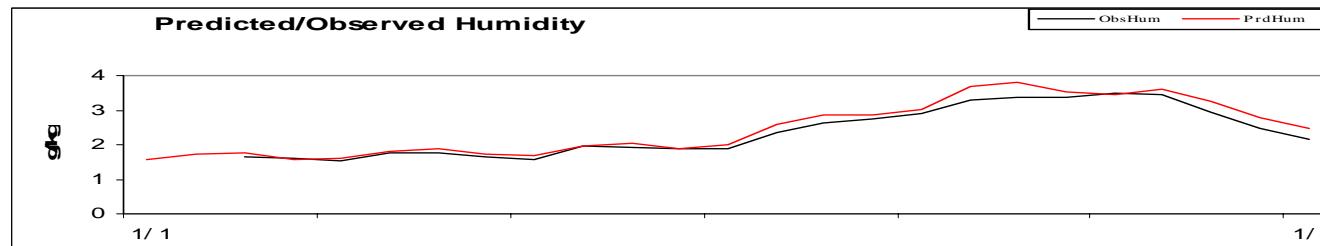


Pleim-Xiu
Day 8-14

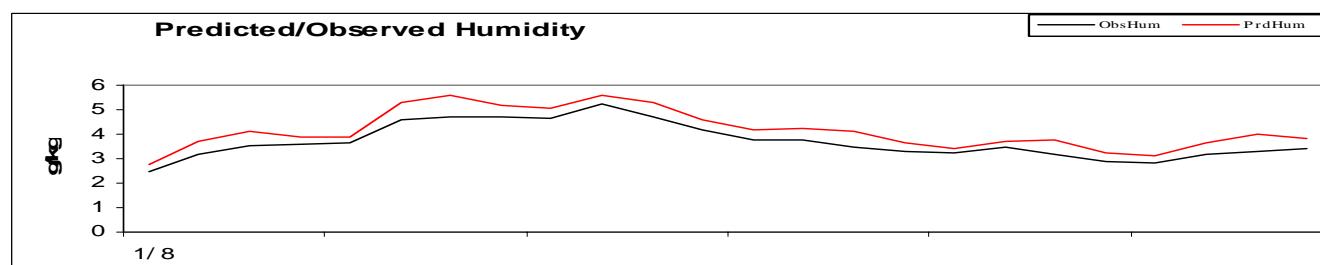


Comparison of Hourly Observed/Predicted Humidity

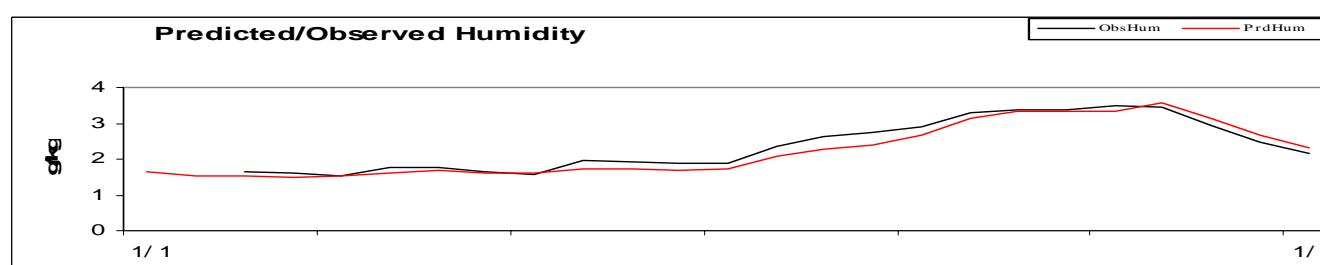
Eta
Day 1-7



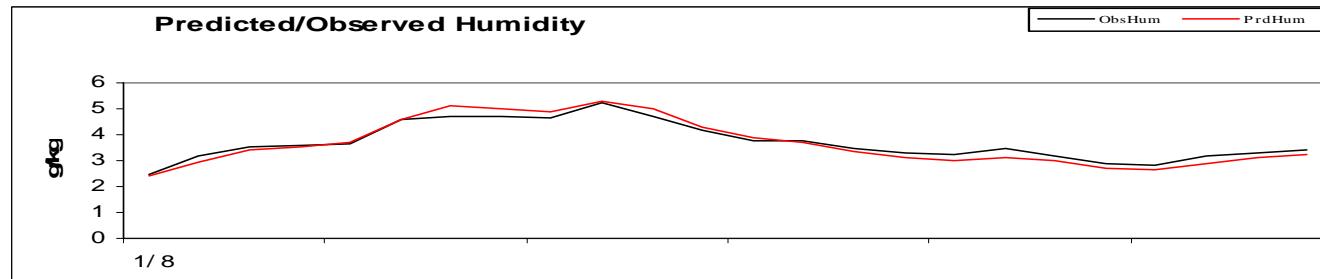
Eta
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Day 1-7

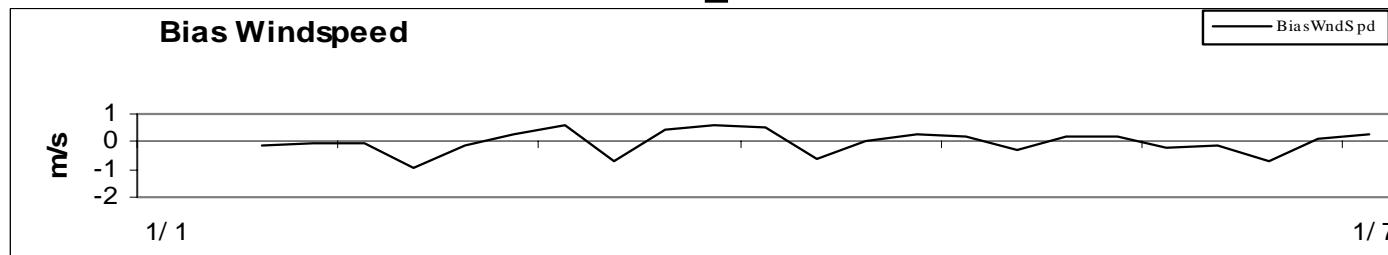


Pleim-Xiu
Day 8-14

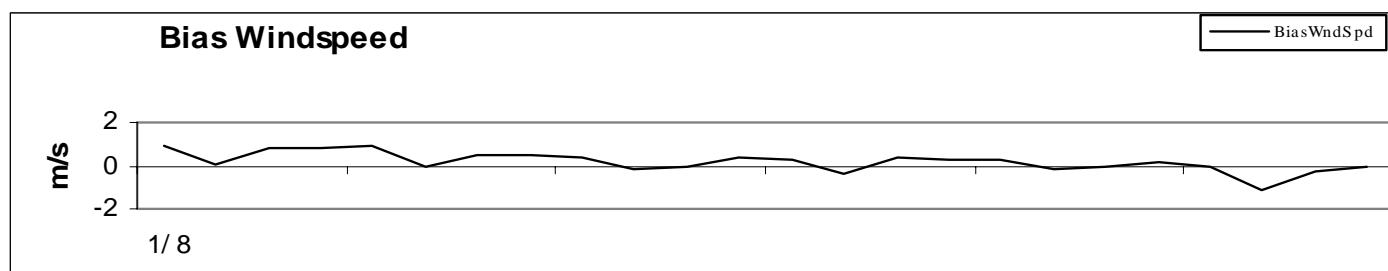


Comparison of Hourly Bias Error Windspeed

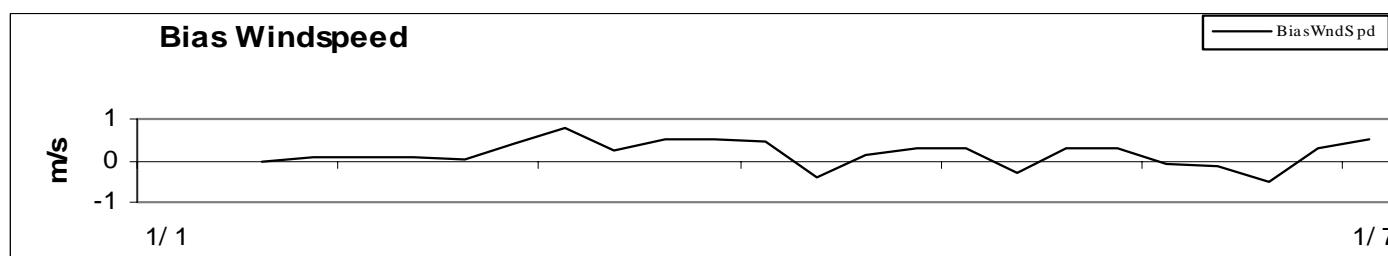
MRF
Day 1-7



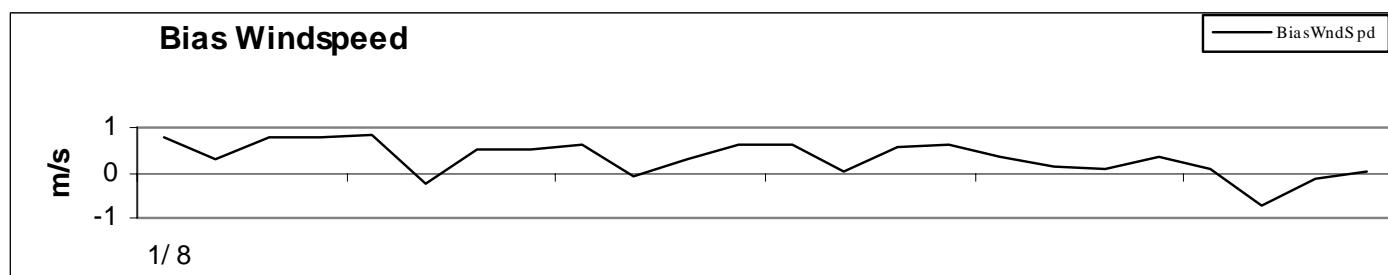
MRF
Day 8-14



Pleim-Xiu
Day 1-7

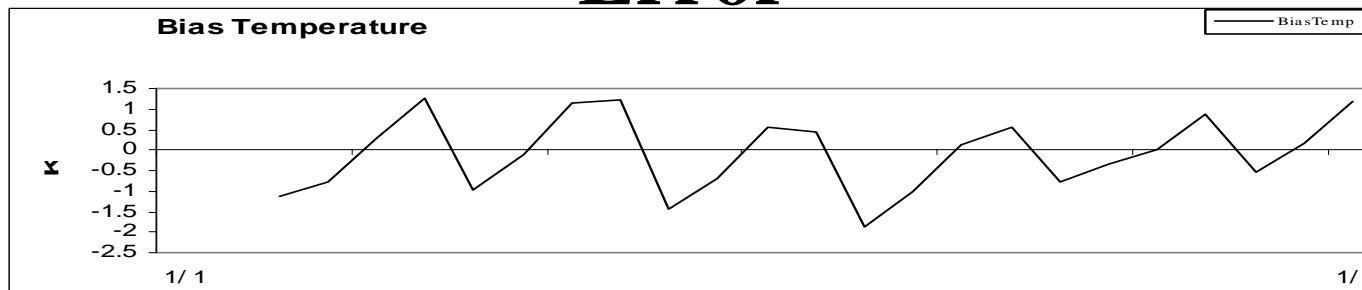


Pleim-Xiu
Day 8-14

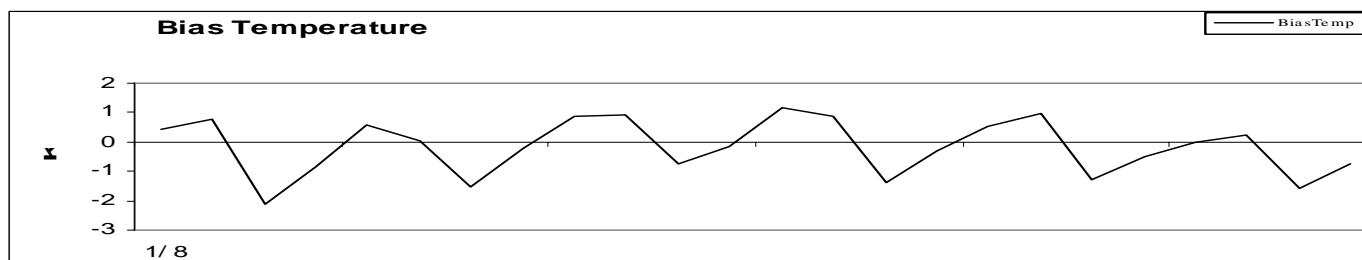


Comparison of Hourly Temperature Bias Error

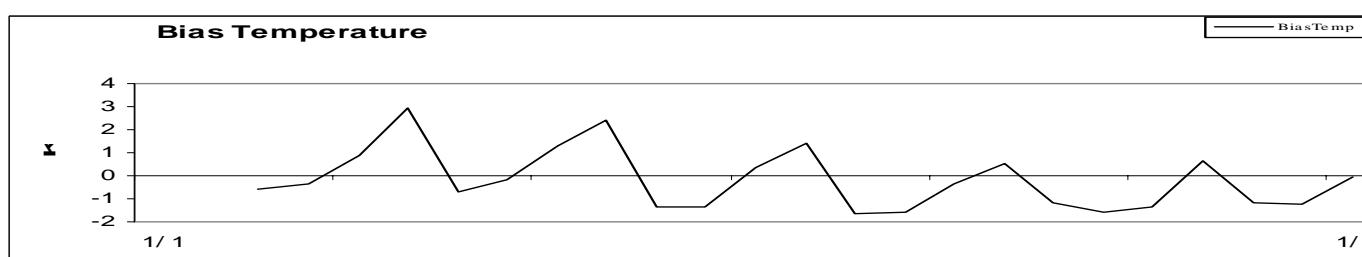
MRF
Day 1-7



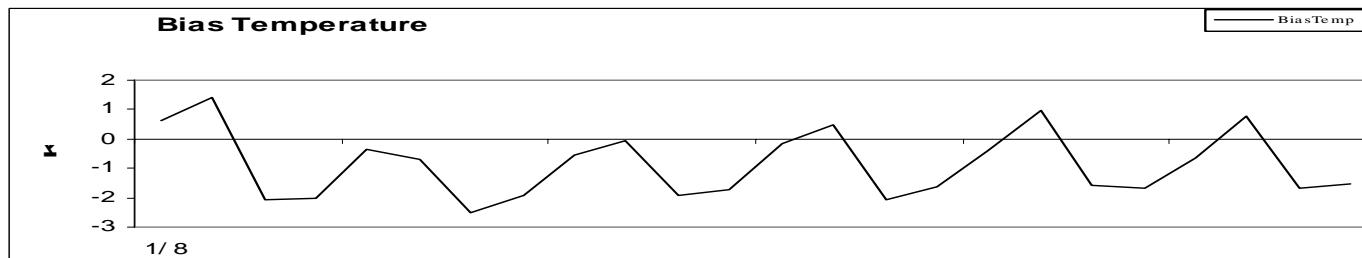
MRF
Day 8-14



Pleim-Xiu
Day 1-7

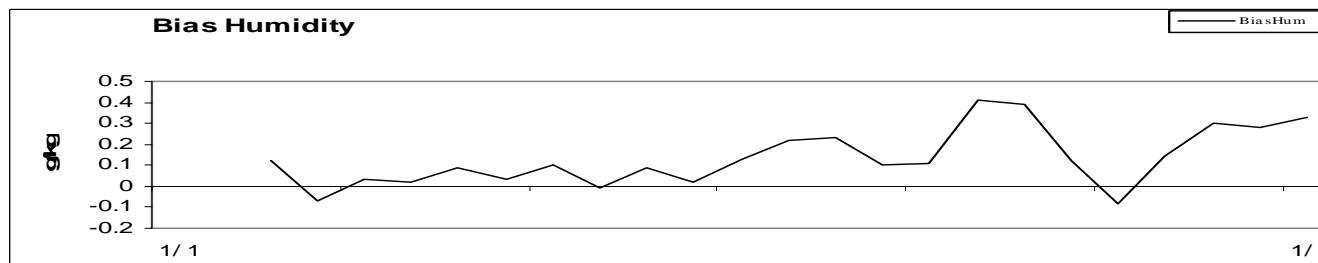


Pleim-Xiu
Day 8-14

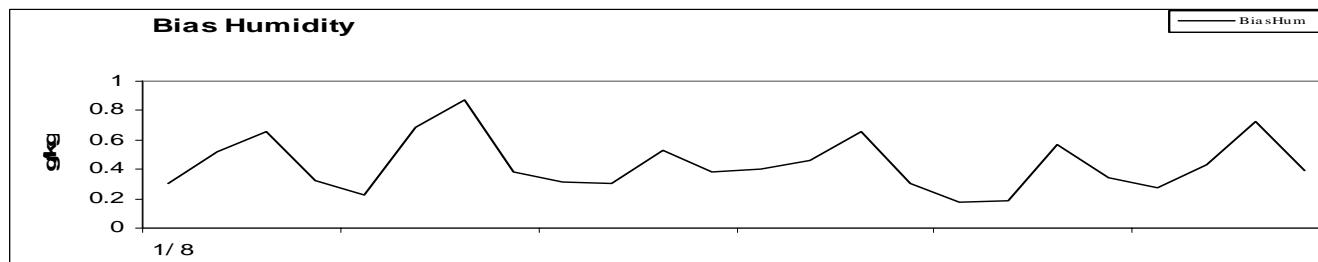


Comparison of Hourly Humidity Bias Error

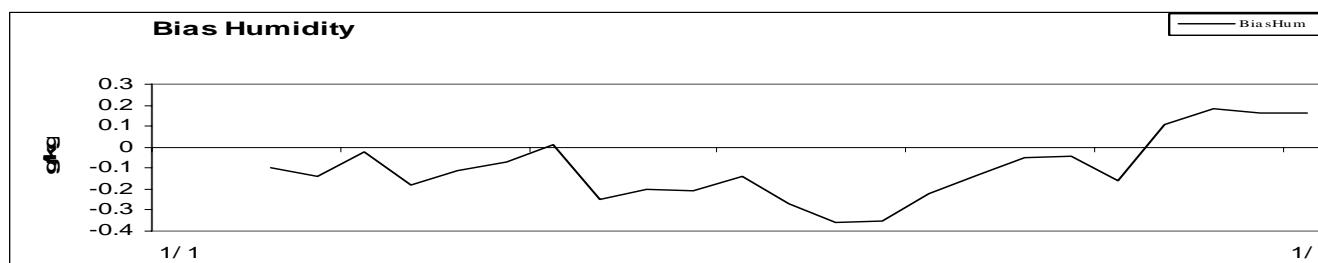
Eta
Day 1-7



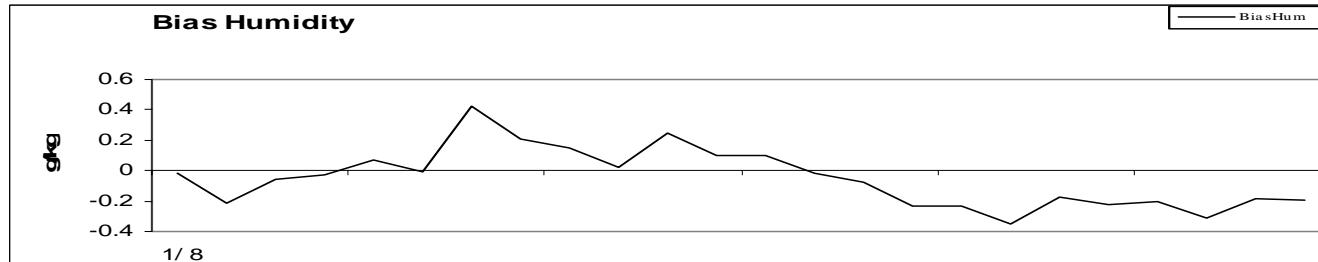
Eta
Day 8-14



Pleim-Xiu
Day 1-7



Pleim-Xiu
Day 8-14



Summary 2002 MM5 Model Performance

- All four MM5 model runs preformed well in daily analysis
 - > Generally the Pleim-Xiu scheme was the best overall performer for wind speed/direction
 - BIAS wind speed of + 0.09 mph
 - IOA of 72%
 - BIAS wind direction of + 2.61°
 - > MRF preformed well in temperature evaluations
 - Bias temperatures of -.21K
 - IOA temperatures of 96%
 - > Pleim-Xiu and Eta schemes were the best overall performer for humidity
 - Bias humidity of -0.05 and 0.1 g/kg
 - IOA humidity of 95%

Summary 2002 MM5 Model Performance

- All four MM5 model runs also preformed well in hourly analysis
 - > Pleim-Xiu scheme was again the best overall performer for wind speed/direction
 - BIAS wind speed of + 0.08 mph
 - IOA of 70%
 - BIAS wind direction of + 2.96°
 - > MRF preformed well in temperature evaluations
 - Bias temperatures of -.3K
 - IOA temperatures of 94%
 - > Pleim-Xiu and Eta schemes were the best overall performer for humidity
 - Bias humidity of -0.06 and 0.24 g/kg
 - IOA humidity of 95%

Preliminary Recommendations 2002 MM5 Modeling

- Run MM5 PX for July at 36 km grid
- Run MM5 PX for July and January 2002 using 12 km grid to determine whether higher resolution improves model performance
- If performance issues persist, may want to consider sensitivity tests
 - > LSM Scheme
 - > PBL Scheme
 - > Nudging Data and Assumptions
 - > Other

Comments/Questions

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 > becky.ebert@dnr.missouri.gov

Thank You!